

Review

A review on the medicinal and edible aspects of aquatic and wetland plants of India

Swapna M. M.¹, Prakashkumar R.¹, Anoop K. P.¹, Manju C. N.^{1,2*} and Rajith N. P.³

¹Malabar Botanical Garden, G. A. College P. O., Calicut-14, Kerala, India.

²Zamorin's Guruvayurappan College, G. A. College P. O., Calicut-14, Kerala, India.

³Spices Board, Field Office, Adimali, Idukki-61, Kerala, India.

Accepted 19 December, 2011

A review on medicinal and edible aspects of more than 70 wetland plants of India were discussed here. Some new observations such as the use of *Lindernia crustacea* to clear stomach, *Nelumbo nucifera* as a delicious food item and sold in the name, 'vattal', *Colocasia esculenta* for the treatment of cracked foot, *Cyperus rotundus* for relief from stomach ache in children and *Centella asiatica* to cure jaundice and peptic ulcer are reported for the first time.

Key words: Wetland plants, review, medicinal, edible, India.

INTRODUCTION

Wetlands are vital ecosystems which provide livelihoods for the millions of people who live within and around them. Man depends on wetlands for most of his needs from time immemorial. Most of the human civilizations arose around the wetland systems. Even today man depends on the wetlands for multiple purposes such as drinking water, agriculture, fishing, etc. Wetlands perform some important functions in relation to climate change. They have mitigation effects through their ability to sink carbon, and adaptation effects through their ability to store and regulate water. Mangroves, floodplains, highland and other wetlands can reduce the impacts of increased precipitation, storms, glacier melting and even sea level rise. The water regulating and storage functions of these wetlands are crucial in adapting to a changing climate. Therefore, in order to protect people living close or even far downstream from wetlands and their source of livelihoods, we must conserve and restore wetlands.

The plants of wetland ecosystems played fascinating role in the life of human beings in earlier days as food, fodder, medicine, etc. But with the advancement of life pattern, the uses of wetland plants are foregone and they are treated as noxious weeds and the wetlands as useless situations. Though the aquatic situations of India are rich repositories of various plant species, not much

work as been undertaken to enumerate the food values and medicinal uses of them.

Maya et al. (2003) analyzed the economic importance of river vegetation of Kerala and gave the uses of 35 species including bank species apart from the true aquatic/wetland species. Panda and Misra (2011) provided information about ethnomedicinal uses of 48 wetland plant species of South Orissa and discussed their conservation.

The present work reviews the utilities of wetland plant species as food and medicine with the help of authentic publications and by the incorporation of traditional knowledge of local communities in this aspect. The aquatic plants of importance are enumerated in alphabetical order. Each one with the scientific name followed by the family, common name/local name, if any, distribution, habitat, characteristic features, and a review on the importance and usage of the species.

ENUMERATION OF SPECIES

Acorus calamus Linn.

Acoraceae; Vayambu, Sweet flag; North temperate hemisphere and Tropical Asia; widely distributed in wild or as cultivated species in India; the plant thrives in marshy places and moist situations; Erect herbs, rhizome creeping, aromatic, spadix sessile, free from the spathe;

*Corresponding author. E-mail: manjucali@gmail.com.

flowers densely arranged, ovary with sessile stigma, punctuate; fruiting very rare.

Young leaves and rhizomes are edible. The dried rhizome in the form of an infusion is an aromatic, bitter tonic and carminative. The dried root which are collected in the autumn, are used for flavoring, to aid digestion, and as a cure for toothache. Ground rhizome mixed with cow milk is taken to cure stomach ache. The medicinal properties are due to the presence of a glucoside, acorin (Usher, 1984). In *A. calamus* rhizomes are considered to possess anti-bacterial, anthelmintic properties and also used for treatment of chronic diarrhea, dysentery, bronchial catarrh, intermittent fevers and tumors (Chopra et al, 1957; Baxter, 1960). The extracts of *A. calamus* have been found to possess an antibacterial activity (Grosvenor et al., 1995; Rani et al., 2003). Bhuvaneshwari and Balasundaram (2009) reported that the Beta-Asarone fraction of the rhizome has stronger antibacterial activity. Balakumbahan et al. (2010) made an over view of the pharmacological properties and insecticidal activities of the plant.

***Aeschynomene aspera* Linn.**

Fabaceae; Pith plant; Indo-Malaysia; found throughout in India; growing in and along tanks and lakes; stems erect or trailing and floating, stems thick and spongy, leaves shortly petiolate, flowers yellow and sepals hairy.

Aerial part juice is given to cure cough and cold fever. Dried young shoot powder with half teaspoon powdered sugar candy is given to increase the consistency of semen (Panda and Misra, 2011).

***Alternanthera philoxeroides* Griesebach**

Amaranthaceae; Kozhuppa, Alligator weed; Native of South America; now established in Indo-Malaysia and Australia; in India: distributed in Assam, Bihar, Jammu and Kashmir, Kerala, Karnataka, Meghalaya, Manipur, Madhya Pradesh, Orissa, Uttar Pradesh and West Bengal; the plant grows in a variety of habitats including dry lands, but is usually found in water, it may form large interwoven mats over the water or along shore lines; perennial herbs, often much branched and forming dense patches. Leaves opposite, elliptic-lanceolate; midrib prominent, inflorescence axillary or terminal, ovoid-globose, heads white, pedicellate and terminal ones sessile.

In Kerala (Madhusoodanan and Kumar, 1993) and West Bengal, it is sold in the market as a vegetable. It is also used as medicine. Sulphated polysaccharide compounds isolated from the plant show significant *in vitro* anti HIV activity (Lewis and Lewis, 2003). Young shoot paste along with black pepper is prescribed to cure acute cough. Leaves with a pinch of salt are orally administered to cure intestinal worms (Panda and Misra,

2011).

***Alternanthera sessilis* R. Brown ex DC.**

Amaranthaceae; Kozhuppa, Sessile Joyweed; Pantropical. In India: widely distributed; terrestrial plant found in seasonally water logged soil, but particularly common at the edges of tanks, rivers, canals and ditches; Flowers white, small, in dense globose heads (Singh, et al., 2009). In South East Asia, young shoots and leaves are eaten as a vegetable (Scher, 2004). The leaves are eaten usually with fish, in Congo; eaten cooked in Malaya, and cooked with rice in Indonesia (Usher, 1984). In Nigeria, it is used to relieve head ache and dizziness, and it is considered to be a viable treatment for snakebites and to stop the vomiting of blood. In Taiwan, it is often combined with other medicinal herbs to treat bronchitis, asthma and hepatitis.

In Thailand and Sri Lanka, the leaves are boiled and ingested to treat hypertension. The plant enhances secretion of milk in new mothers (Naples, 2005) and it is used as a remedy against intestinal cramps, diarrhoea and dysentery (intestinal disorder), and externally as a cooling agent to treat fever.

***Ammannia auriculata* Willd.**

Lythraceae; Paleotropics. In India: Bihar, Himachal Pradesh, Haryana, Karnataka, Kerala, West Bengal, Uttar Pradesh, Rajasthan and Punjab; Annual or perennial plants found in wet places, marshes, river banks and rice fields; Erect herbs, flowers in axillary cymes, capsules globose, red. It is used as a counter irritant for rheumatic pains (Cook, 1996).

***Ammannia baccifera* Linn.**

Lythraceae; Kalluruvi; Tropical Africa, Asia, Europe and Australia. In India: Widely distributed; Annual herbs found in wet places such as marshes, river banks, rice fields, etc., rarely found in permanent water; Stems decumbent or erect, cymes compact, globose, flowers reddish brown. The fresh leaves have been used in skin diseases as a rubifacient (Wealth of India, Vol. I). It is used locally in medicine as a counter irritant and considered to be poisonous (Cook, 1996). Leaf juice with honey is given in empty stomach to cure typhoid. Leaf paste with common salt is applied on the affected areas to cure skin diseases such as scabies, ring worm, skin itching, etc. (Panda and Misra, 2011).

***Aniseia martinicensis* Choisy**

Convolvulaceae; Venthiruthali; Pantropical, In India this species is distributed in Kerala and Karnataka; Annual or

perennial. Mostly near to the coast, usually among thickets near rivers and canals; Stems twining and glabrous. Flowers solitary in axils or in cymes, white. The leaves are edible (Cook, 1996).

***Bacopa monnieri* (Linn.) Pennell**

Scrophulariaceae; Neerbrahmi, Bacopa; Paleotropics, widely distributed in India; perennial or annual herbs found in marshy places, the banks of pools and along the streams and ditches; Stems creeping with ascendant or erect branches, leaves decussate, succulent, flowers pedicellate, white to pink or pale violet.

The plant contains *hersaponin* which is used in medicine as a potent diuretic, cardiac tonic and tranquilizer. Plants boiled in water are used as purgative or skin lotion (Cook, 1996). A medicated ghee prepared from the plant is found to be beneficial for epilepsy and hysteria. The powdered, dried leaves gave satisfactory result in case of asthenia, nervous break down and other low adynamic conditions (Wealth of India, Vol I). In Pakistan, the herbal drug, Brahmi-buti, is used to treat skin diseases, leprosy, epilepsy, eczema, asthma, hoarseness of the voice, and diseases of the nervous system (Abdul et al., 1994). Singh and Singh (1980) reported '*Brahmi*' as an excellent remedy to lower anxiety and blood pressure and to increase memory power through a clinical trial with 35 patients. This plant is also used as a potent antioxidant (Tripathi et al., 1996).

***Centella asiatica* Urban**

Apiaceae; Kudangal, Indian Pennywort; Tropical Asia and Africa, In India widely distributed; a prostrate perennial aromatic herb growing wild along stream sides, paddy fields and other wet places; stem reddish, leaves in rosettes, inflorescence single and axillary umbel.

Fresh plant dissolved in dry vegetable preparation or salad is used to increase memory power. It is also commonly used as porridge for feeding pre-school children in combating nutritional deficiencies (Cox et al., 1993). Fresh plant ground to make a paste, which is boiled in 1 glass of cow milk and taken in the early morning for 7 days to cure jaundice and leucorrhoea. Fresh tender leaves are chewed and taken to relieve from acidity and peptic ulcer (Pers. Obs. Rajith). Infusion of the plant is used in India and Madagascar in the treatment of leprosy. It is one of the local herbs that is claimed to possess various physiological effects and it occupies an important place in the indigenous system of medicine as a tonic in skin diseases and leprosy (Chopra et al., 1956). It is commonly used for wound healing in many places (Hong et al., 2005; Shetty et al., 2006), memory improvement, treatment of mental fatigue, bronchitis, asthma, dysentery, kidney trouble, urethritis,

allergy, leucorrhoea and toxic fever (Kan, 1986) and it is also used as a constituent of brain tonics for the mentally retarded (Kartnig et al., 1988). It is having the property to promote fibroblast proliferation and collagen synthesis (Maquart et al., 1990). Abdulla et al. (2010) suggested that *C. asiatica* leaf extract promote ulcer protection as ascertained grossly and histologically compared to the ulcer control group.

***Centipeda minima* A. Braun and Ascheron**

Asteraceae; Sneezweed; Indo-Malaysia, In India this species is distributed in Kerala, Tamil Nadu, Karnataka, Madhyapradesh, Assam, Punjab, Missoram, Rajasthan and Uttar Pradesh; Short lived annual found in wet places, marshy banks and submerged in shallow water, flowering as the water recedes; Stem erect or spreading from a single tap root, leaves alternate, numerous, flowering heads sessile, solitary, yellow, cypselas minute, 4- angled and bristly on the angles.

Promote sneezing and thus relieves nasal congestion, also used to treat swellings and inflammation. Based on the record in the Pharmacopoeia of China (Lin and Shi, 2005), the dried herb is used to treat nasal allergies, rhinitis and sinusitis, coughs and headaches. In addition, it is used in the Chinese folk medicine to treat nasopharyngeal carcinoma (NPC) (Cheng and Li, 1998; Zhang, 2000). Recent pharmacological interest has focused on its anti-allergy and antibacterial effects (Wu et al., 1985, 1991).

Phytochemical studies of its composition have led to the identification of a number of terpenes, including sesquiterpene, lactones and triterpenes (Wu et al., 1985, Bohlmann and Chen, 1984). The former class contained the major active constituents contributing to the anti-allergy and anti-bacterial activities of the herb. Su et al. (2009) reported the potent antiproliferative effect of *C. minima* on Nasopharyngeal Carcinoma cells. Dried leaf powder with mustard oil is inhaled to remove nasal congestion. Fresh plant paste is applied externally to subside body swelling and inflammation (Panda and Misra, 2011).

***Caesulia axillaris* Roxb.**

Asteraceae; Endemic to Indian subcontinent, In India it is distributed in Andhra Pradesh, Bihar, Delhi, Gujarat, Goa, Karnataka, Maharashtra, Uttar Pradesh and Rajasthan; Found rooted or floating in shallow water at the edges of tanks, also in marshes, canals and ditches; Stems creeping, ascending or erect with violet to brown longitudinal strips, rather swollen at the nodes, flower heads sessile, disseminules are flattened and winged cypselas. Whole plant paste with camphor and mustard oil is applied on chest and throat to cure cold, cough and

nasal congestion. Paste of the inflorescence with black pepper and cow milk is given to cure dysentery. Whole plant extract is given to cure malaria (Panda and Misra, 2011).

***Coix aquatica* Roxb.**

Poaceae; endemic to Peninsular India; In India, the species is found in Andhra Pradesh, Assam, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Rajasthan, Orissa, West Bengal; Perennial herbs with culms floating or creeping; Culms with swollen, floating roots when in water, upper surface of the leaf blades with conspicuous glands which bear bristle like hairs. Root paste with cow urine and black pepper made in to small tablets are given to cure painful urination and menstrual complaints (Panda and Misra, 2011).

***Coix lachryma – jobi* Linn.**

Poaceae; Poochakkal; native of Tropical Africa, introduced elsewhere, distributed almost throughout in India; Annuals, common in and around marshes, along water courses, and rice fields; culms tufted, leaves linear – lanceolate, spikelets terete or partly flattened, white – yellowish white or bluish grey. The roots are used in the treatment of menstrual disorder and chickenpox (Santhoshkumar and Satyanarain, 2010).

***Coldenia procumbens* Linn.**

Boraginaceae; Cherupulladi; Pantropical, In India: Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Assam, Delhi, Gujarat, Goa, Madhya Pradesh, Rajasthan, Uttar Pradesh and West Bengal; Annual in shallow water, on moist ground in seasonally flooded areas, beds and margins of drying tanks and harvested rice fields; Trailing herbs, stems and leaves softly white villous, inflorescence few flowered and sessile cymes. Paste of the whole plant is applied around the boils as suppurate and to get relief from pain and swelling (Panda and Misra, 2011).

***Colocasia esculenta* Scott.**

Araceae; Chembu, Taro; Pantropical, In India, this species is distributed in Kerala, Karnataka, Goa, Maharashtra, Assam, Delhi, Manipur, Mizoram, Rajasthan, Sikkim and West Bengal; Perennial herbs with tuberous stems and stolons found in marshy places, streams, rivers and ponds, in deep water it may develop floating leaves; Inflorescence axillary, differentiated in to basal green convolute tube and upper, expanded, yellow

limbs. Widely cultivated for its starchy rhizome. The leaves are rich in vitamins and minerals and hence used as vegetable. The leaf made into dry vegetable preparation is useful for the relief from constipation. The toxin, calcium oxalate present in the plant can be destroyed by cooking (Thomas, 2008). The outer skin of fresh petiole is peeled and tied on the affected part against cracked feet (Pers. Obs. Rajith).

***Commelina benghalensis* Linn.**

Commelinaceae; Kanavazhai; India, China, Japan, Malaysia and Africa, In India widely distributed; Perennial or annual; A widespread weed not confined to wetlands but often found in ditches, wet field and places subjected to flooding. Diffuse herbs, rooting at lower nodes, rootstock with cleistogamous flowers and flowers are blue.

Fried leaves are given as leafy vegetable to cure constipation. Warm leaf juice is dropped in ear to get relief from earache. Leaf juice with coconut oil is applied externally to cure leprosy and skin inflammations. Warm dried leaves are given to cure rheumatic pain (Panda and Misra, 2011).

***Commelina diffusa* N. L. Burman**

Commelinaceae; Creeping Dayflower; Pantropical. In India: Kerala, Karnataka, Goa, Tamil Nadu, Gujarat, Bihar, Mizoram, Punjab, Sikkim and West Bengal; Perennial or annual. Common weed usually found in damp shady places near water, open swamps and marshes; Trailing or diffuse herbs, rooting at lower nodes, leaf sheath ciliate, flowers blue. The bruised plant is used locally against burns, itches and boils (Panda and Misra, 2011).

***Commelina erecta* Linn.**

Commelinaceae; White mouth dayflower, India, Africa and Australia; distributed almost throughout in India; found in grasslands and moist deciduous forests; stems erect or ascending, with reddish purple striations, flowers in terminal cymes and blue.

Leaf pasted along with seeds of *Brassica campestris* var. *sarson* is applied on the affected area to subside rheumatic swelling (Panda and Misra, 2011). As a refrigerant for skin inflammation, leprosy and constipation (Santhoshkumar and Satyanarain, 2010).

***Cryptocoryne retorspiralis* Kunth**

Araceae; Water trumpet; Distributed in South and North

East India; Perennial, mostly in sand or gravel along rivers, where it often forms turf - like communities; Rhizomes up to 1.5 cm thick and knotty, with stolons, bearing long, thick, contractile roots, leaves erect or spreading; petioles shorter than the blade. It is used locally in medicine (Cook, 1996). The fresh tuber paste is applied twice a day to relieve from boils and burns (Kamble et al., 2010).

***Cyanotis axillaris* Sweet**

Commelinaceae; Indo-Malaysia, In India: Kerala, Maharashtra, Madhya Pradesh, Andhra Pradesh, Assam, Bihar, Delhi, Gujarat, Haryana, Karnataka, Rajasthan, Uttar Pradesh and West Bengal; Annual or perennial found in swamps and marshes, abundant in rice fields and irrigation ditches; Stem creeping, ascending or erect, leaf sheath inflated, glabrous or hairy, margin ciliate, inflorescence, a dense cyme with 3 to 6 flowers, embedded in the hollow axil of a swollen leaf sheath.

It is used locally in medicine for ascites and abortions (Cook, 1996). Warm leaf juice is dropped into the ear to get relief from inflammation in the eardrum.

***Cyathocline purpurea* O. Kuntze**

Asteraceae; Indo-Malaysia, In India: Goa, Gujrat, Karnataka, Assam, Bihar, Himachal Pradesh, Jammu and Kashmir, Maharashtra, Manipur, Madhya Pradesh, Meghalaya, Punjab and West Bengal; Annual or occasionally perennial, found in water logged soil, places subjected to seasonal inundation and along water courses; stem erect, with longitudinal ribs, simple or scarcely branched, flowering head pedunculate, in terminal corymbs, flowers is dark purple-red. It is aromatic, used in medicine against headache (Cook, 1996). Ma et al. (2009) identified the anticancer activity of sesquiterpene lactones from the plant.

***Cyperus iria* Linn.**

Cyperaceae; Tropical Asia and East Africa, introduced in U.S.A. and West Indies, In India, it is widely distributed; Annual or perennial, a common weed of cultivated ground, found also in marshes and ditches; Culms triquetrous, leaves few, sheaths purplish brown, inflorescence compound and spikelets yellowish. Fresh plants, particularly the roots are aromatic and used locally in medicine (Cook, 1996). In India the juice of the plant is used as a tonic and to treat stomach complaints (Usher, 1984).

***Cyperus rotundus* Linn.**

Cyperaceae; Muthanga; Pantropical, Widely distributed in

South India; Rhizome stoloniferous, leaves few basal, inflorescence simple or compound, spikelets compressed, brown; Perennial, found on river banks, dried up pools and ditches and in rice fields.

Tubers are collected, roasted and eaten. The tubers contain cyperene, cyperone, cyperol and 1- pinene which are used for spasms or as an emmenagogue. It is also used in cooling indigenous medicines (Cook, 1996). The fresh rhizome ground and boiled with cow milk is given to children to get relief from stomach ache (Pers. Obs. Rajith).

***Dentella repens* (Linn.) J. R. and J. G. A. Forster**

Rubiaceae; Indo – Malaysia, it is found throughout in India; stems creeping, rooting, much branched, stipules transparent with few hairs, flowers solitary, axillary, white with a purplish spot at the base; annual or perennial, on drying out mud around pools and rice fields, river banks and in marshy areas. Leaves are used for poulticing sores (Santhoskumar and Satyanarin, 2010).

***Eclipta prostrata* (Linn.) Linn.**

Asteraceae; Kaiyunni; Pantropical, in India it is widely distributed; usually annual but also in very wet conditions, it will perennate by rooting at the nodes, common in and along the edges of pools, tanks, canals, ditches and rice fields; Diffuse or ascending herbs, stem and leaves sparsely strigose with bulbous based hairs and the head is white.

Fresh plant crushed and expressed juice is taken against ulcer. A preparation obtained from the juice of the leaves boiled with Sesamum or coconut oil is used for anointing the head to render the hair black and luxuriant. The leaves are used as vegetables in Java, they are used in some parts of India, in chutneys. The herb is used as tonic and deobstruent in hepatic and spleen enlargements, and in skin diseases, the plant juice is administered in combination with aromatics for catarrhal jaundice, the expressed leaf juice, along with honey is a popular remedy for catarrhal in infants, the fresh plant rubbed on the gums in tooth ache and applied with a little oil for relieving head ache (Wealth of India Vol.3). Leaf juice is applied directly on scalp for better hair growth and darkening of hair. Leaf juice is prescribed to cure mental disorders; poured into the nostril to get relief from head ache. A mixture of leaf juice and a pinch of table salt are applied on eczema for healing. Leaf decoction is applied on the affected area to relief pain of scorpion sting (Panda and Misra, 2011).

***Eleocharis dulcis* Trinius ex Henschel**

Cyperaceae; Chinese water chestnut; Paleotropics, in

India it is a widely distributed species; Perennial, gregarious in shallow water in ponds, rice fields and along irrigation canals; Rhizome short with long stolons bearing subglobose tubers, culms terete, leaves reduced to bladeless sheets, inflorescence with a single spikelet, spikelet as wide as culms.

It is cultivated for its edible tubers. In Western markets they are often sold under the name 'Chinese water Chestnut'. The above ground parts are high in protein and low in fiber. It has been recommended to be cultivated for its leaf proteins. The corms have a crisp white flesh and can be eaten raw, slightly boiled, grilled, pickled or thinned. They are popular ingredient in Chinese dishes. The corms are rich in carbohydrates, especially starch and are a good source dietary fiber, riboflavin, Vitamin- B6, potassium, Copper and Manganese (Thomas, 2008).

***Epaltes divaricata* Cassini**

Asteraceae; distributed in India, China, Myanmar, Indonesia and Java, in India it is found in Goa, Karnataka, Kerala, Orissa and Tamil Nadu; Annual, found in standing water, ditches, marshes and rice fields; Stems spreading, much branched, three or four winged, leaves fleshy, heads globose, flowers tubular and pink to purple in color.

The roots are bitter and used as astringent tonic (Cook, 1996). Used in traditional Ayurvedic medicine to alleviate jaundice, urethral discharges and acute dyspepsia. It is also regarded as a diaphoretic, diuretic and a stimulating expectorant (Jayaweera, 1981). Hewawasam (2004) reported the significant hepatoprotective activity of the plant on carbon tetrachloride induced hepatotoxicity in mice.

***Glinus oppositifolius* (Linn.) A. DC.**

Molluginaceae; Bitter cumin. Kaipacheera; Pantropical, distributed almost throughout in India; found along open areas, lake shores, stream banks; prostrate herbs, leaves in apparent whorls, flowers white in axillary fascicles.

The leaves are used as vegetable for cooking purposes, as well as an expectorant and antipyretic agent (Sahakitpichan et al, 2010). The plant is used against various types of illnesses related to the immune response, like joint pains, inflammations, fever, malaria and wounds (Inngjerdingen et al., 2005). Whole plant paste is applied externally against various types of skin diseases such as scabies, itches, etc. (Panda and Misra, 2011).

***Grangea maderaspatana* Poiret**

Asteraceae; Nelampala; Indo-Malaysia and Africa, Widely

distributed in India; Annual, occasionally perennial, found at the edges of tanks, canals and ditches, also in rice fields; A procumbent hairy annual with spreading stems, flower heads globose and yellow.

The juice of the leaves is employed as an instillation for ear-ache. The leaves are regarded as stomachic, deobstruent and antispasmodic and prescribed in infusion or electuary (Wealth of India Vol. IV). Plant paste with cow milk and sugar candy is given to cure menstrual disorders. Leaf paste with honey is given to cure stomach disorders (Panda and Misra, 2011).

***Heliotropium indicum* Linn.**

Boraginaceae; Thelkada; Pantropical, widely distributed in India; Annual, found in seasonally flooded places, in rice fields, on sandy riverbanks and along streams, also found in roadsides and waste lands; A coarse foetid herb, branches hirsute, flowers in bristly scorpioid cymes.

Reported to possess emollient, vulnerary and diuretic properties. A decoction of the tender shoots is reported to be pectoral and antiscabious. The flowers are considered as emmenagogue in small doses and abortifacient in large doses (Wealth of India Vol. V). Fresh whole plant ground and made in the form of paste is applied on the affected area against scorpion sting. Leaf juice is dropped into eyes to cure cataract, redness and conjunctivitis. Whole plant paste is tied up the minor cuts and wounds as antiseptic for healing (Panda and Misra, 2011).

***Hydrolea zeylanica* Vahl**

Hydrophyllaceae; Cheruvallel; Pantropical. In India it is widely distributed; Perennial or annual, seasonally submerged, emergent or helophytic; an erect or diffuse, succulent herb, flowers blue, glandular hairy, seeds numerous and minute.

Young shoots are eaten as vegetable and are reported to have antiseptic properties and are used in medicine (Cook, 1996). Young leaves are eaten with rice in Java (Usher, 1984). The leaves are considered to possess cleansing and antiseptic properties. Paste of whole plant with coconut oil is applied in minor cuts, wounds and boils as antiseptic for quick healing (Panda and Misra, 2011).

***Hygrophila schulli* (F. Hamilton) M. R. and S. M. Almeida**

Acanthaceae; Vayalchulli; India, Myanmar and Indo – China. In India it is found in Assam, Bihar, Gujrat, Goa, Karnataka, Kerala, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal; perennials found in swamps, temperory pools, at the edges of tanks, canals and

ditches and in rice fields; subshrubby herbs with axillary spines, stems hispid, flowers in axillary whorls, surrounded by spines, blue, purple or pink in color.

Seed powder mixed with raw cow milk is taken in the morning for treating impotency. Leaf juice is given to patients of anemia. Dry seed powder mixed with milk and sugar candy is taken to cure spermatorrhoea (Panda and Misra, 2011). The whole plant, roots, seeds, and ashes of the plant are extensively used in traditional system of medicine for various ailments like rheumatism, inflammation, jaundice, hepatic obstruction, pain, urinary infections, oedema and gout (Shanmugasundaram and Venkataraman, 2005).

***Hygroryza aristata* (Retzius) Nees ex Wt. and Arn.**

Poaceae; Neervallipullu, Bengal wild rice; distributed in India and Sri Lanka; Annual floating glabrous grass; culms creeping or trailing, floating, rooting at internodes, leaf sheath inflated, inflorescence a pyramidal panicle and spikelets solitary.

The grains are eaten by the poor people (Cook, 1996). They are reported to be sweet, digestible and cooling and useful in biliousness (Wealth of India, Vol. V). Chung et al. (2011) isolated and tested the anti-inflammatory and antioxidant components from the plant which showed significant activity.

***Ipomoea aquatica* Forsskal**

Convolvulaceae; Kozhuppa; Pantropics, widely distributed in India; Perennial, usually floating on stagnant water but sometimes found in the banks of pools, canals and rivers; An aquatic, trailing or floating, herbaceous perennial with long, hollow stem rooting at the nodes, flowers white or pale purple with dark purple eye. The young terminal shoots and leaves are used as vegetable and in salad. The stems are sometimes pickled. The Burmese use the juice as an emetic in case of opium and arsenical poisoning. Dried juice has purgative properties. Leaves and stems are said to be cooling.

The buds are used in the treatment of ring worm. In Assam, the plant is given for nervous and general debility. Fried leaves are taken to cure head reeling. Leaf juice along with cow ghee is given to cure gonorrhoea; is a purgative and acts as blood purifier (Panda and Misra, 2011).

***Ischaemum rugosum* Salisbury**

Poaceae; Kadukkan pullu; Tropical Africa and Asia, in India it is distributed in Kerala, Karnataka, Tamil Nadu, Goa, Gujrat, Andhra Pradesh, Maharashtra, Maniput, Punjab, Rajasthan, Uttar Pradesh and West Bengal;

common in wet places and in rice fields, grows in standing water also; A tufted, erect, annual grass with flat, glabrous or sparsely hairy leaves and oblong grains. The grains are eaten at times of scarcity. Analysis of the plant at flowering stage revealed the presence of considerable amount of protein, carbohydrate etc. (Wealth of India, Vol. V).

***Lagenandra ovata* Thw.**

Araceae; andavazha; endemic to South West India and South West Sri Lanka; found in Goa, Karnataka, Kerala and Tamil Nadu in India; grows along streams and ditches in open and shady situations also at the edges of rice fields; leaves erect, spathe twisted and swollen above the kettle, opening by a narrow slit, outer surface of the spathe dark purple, warty, inner surface finely striate, seeds 3 to 5.

It contains acrid juice, used in the ointments for skin problems, tubers used locally for the treatment of kidney disorders and swelling (Maya et al., 2003).

***Limnophila indica* (L.) Druce**

Scrophulariaceae; Manganari; pantropical, distributed throughout India; aerial stems erect or creeping below, with or without eglandular hairs, heterophyllous, flowers pedicellate, solitary, white, pale yellow or blue – purple.

Juice of aerial part of plant with ginger and cumin is prescribed to cure dysentery. The same is applied externally on cuts and wounds as antiseptic (Panda and Misra, 2011).

***Lindernia anagallis* (Burm. F.) Pennell**

Scrophulariaceae; Indo – Malaysia. It is found throughout India; gregarious and locally abundant in marshy places, banks of pond and rivers and wet rice fields; stems glabrous, creeping and rooting at nodes, flowers solitary in the axils of leaf like bracts, white to pink or purple with or without white flashes on the lip. Whole plant paste along with black pepper is given for gonorrhoea (Panda and Misra, 2011).

***Lindernia ciliata* (Colsmann) Pennell**

Scrophulariaceae; Indo – Malaysia, throughout in India; stems erect or ascendant, leaves glabrous, margins saw – like, flowers in terminal laxly – flowered racemes, white to pink or blue with a blue or purple throat; annuals, found along the banks of streams after monsoon, rice fields, damp rocks and in wet grass lands. It is used as a remedy for gonorrhoea (Santhoshkumar and Satyanrain, 2010).

***Lindernia crustacea* (Linn.) F. von Mueller**

Scrophulariaceae; Nilakanjiram; It is found in Africa, America and Tropical and Subtropical Asia and widely distributed in India; Found in low lying pastures, river banks, rice fields after the harvest and drying out tanks; A glabrous, diffusely branched annual, leaves small, ovate, entire or serrate, flowers purple or blue-violet.

It is used for biliousness affections and dysentery in Indo-China and in poultices for boils, sores, ring worm and itches. In some parts of Kerala, the plant is crushed and the expressed juice is taken in early morning in empty stomach to clear stomach (Pers. Obs. Rajith). Leaf paste with lemon juice is given orally to cure excess bile secretion; also applied externally on ringworm and boils (Panda and Misra, 2011).

***Lindernia oppositifolia* (Retzius) Mukherjee**

Scrophulariaceae; In India it is distributed in Karnataka, Kerala, Tamil Nadu, Goa, Gujrat, Orissa, Bihar, Uttar Pradesh and West Bengal; Found in wet low lands, scrub jungle and in rice fields after harvest; Stem erect, leaves sessile or sub sessile, flowers pinkish with or without a yellow fleck at the throat. The roots are used locally for fevers (pers.obs. Swapna).

***Lindernia procumbens* (Krocker) Borbas**

Scrophulariaceae; Indo – Malaysia, in India the species is distributed in Bihar, Jammu and Kashmir, Orissa, Punjab, Rajasthan, Sikkim, Uttar Pradesh and West Bengal; stems erect or ascending, glabrous, leaf blades palmately 3 or 5- nerved, flowers solitary, axillary, pale pink, capsules ellipsoid; annuals found in rice fields, river beds and other moist and muddy habitats. The leaves are used for the treatment of dysentery and against ring worm (Santhoshkumar and Satyanrain, 2010).

***Ludwigia adscendens* (Linn.) Hara**

Onagraceae; Continental Asia, Malaysia and Australia, it is found almost throughout India; it is found in wet swampy places, ponds and ditches; stems prostrate or ascending, bearing silver- white, spongy, spindle- shaped pneumatophores, flowers solitary in leaf axils, creamy white, but yellowish near the base. The Whole plant paste is applied against ulcers and skin diseases (Panda and Misra, 2011).

***Ludwigia octovalvis* (Jacq.) Raven**

Onagraceae; Kattukarayambu; pantropical, found

throughout in India; stems robust, much branched, woody at the base, flowers solitary in leaf axils, yellow, capsules terete; found in wet and swampy places, rivers, ditches, canals or tanks, mostly near cultivated land. The whole plant is given in fever, toxemia, boiled plant is applied on body in fever to reduce body ache (Santhoshkumar and Satyanarain, 2010).

***Marsilea minuta* Linn.**

Marsiliaceae; aquatic or semiaquatic in ponds, paddy fields and marshy places; rhizome long creeping, leaves four, sessile, arranged in clover leaf model, sporocarps borne at the nodes in clusters alternatively. Raw leaf paste is applied on forehead to cure headache and for head cooling. Leaves fried in cow ghee are taken regularly as curry to cure biliousness. Leaf juice along with root extract of *Asparagus racemosus* and sugar candy powder is taken orally or leaf juice with ginger juice and honey is also taken to increase sperm formation. Warm root paste with black pepper is applied around boils as suppurate (Panda and Misra, 2011). Plants are used in cough, spastic condition of leg muscles, etc. and also in sedatum and insomnia. The leaves and sprouts are cooked as vegetable and sold in the market (Dixit and Vohra, 1984).

***Monochoria hastata* (Linn.) Solms-Laubach**

Pontederiaceae; Kola chembu; Widely distributed in India and Malaysia; A perennial herb grows in clumps at the edges of pools, tanks and canals and in ditches. Attains a height of 2 to 3 m during the rains, adjusting its height with the rise in water level; Plant with elongate, creeping, spongy rootstock, leaves long petioled, sagittate, hastate, flowers purplish blue or violet. Tender stalk and leaves are eaten as vegetable in Bengal. Considered as alternative tonic and cooling. Juice of leaves is applied to boils (Wealth of India, Vol. VI).

***Monochoria vaginalis* (N. L. Burman) Kunth**

Pontederiaceae; Karimkoovalam; Widely distributed in India to China, Malaysia and Japan; Highly gregarious in inundated places, in swamps or at the edges of pools, ditches, canals and rice fields; Leaves long petioled, ovate-cordate, or subreniform, flowers blue, capsules ellipsoid.

The entire plant except the roots is eaten as vegetable. In Java, the juice of leaves is taken for coughs and that of roots for stomach and liver complaints, asthma and tooth ache (Wealth of India, Vol. VI). Leaves with ginger juice and honey are taken to cure cough and cold. Root is chewed to cure toothache (Panda and Misra, 2011).

***Murdannia nudiflora* Brenan**

Commelinaceae; Thalipullu; Indo-Malaysia and Africa. Widely distributed in India; found in wet places, paddy fields, marshes, along ditches and in shady, grassy places, an aggressive weed in parts of West Indies; Stems decumbent below and ascending above, branchlets reddish with white nodes, flowers clustered in terminal or axillary cymes, blue or pinkish.

Used locally in the treatment of asthma, leprosy and piles. Root paste with goat milk is prescribed orally to cure asthma. Whole plant paste with common salt is applied on the affected area to cure leprosy (Panda and Misra, 2011).

***Nelumbo nucifera* Gaertner**

Nelumbonaceae; Thamara, Lotus; It is found in South East Asia to far Eastern Russia and Australia, Widely distributed in India; cultivated as a crop, found growing in ponds, tanks, etc; A handsome aquatic herb with stout, creeping rhizome, leaves peltate, glaucous, petioles long, smooth or with small prickles, flowers large, white or rosy. The fruiting torus is sold for the edible carpels embedded on it and are considered superior to cereals in nutritive value. *Nelumbo* honey is much in demand. A paste of the rhizome is applied in ring worm and other cutaneous affections. Carpels are demulcent and used to check vomiting. The milky viscid juice of leaves and flowers bacteriostatic action against Gram positive and Gram negative bacteria (Wealth of India, Vol. VII). The rhizomes are eaten as vegetable or preserved in sugar. They are also ground as a starch (Lotus meal). The seed kernels are also used as a source of starch or eaten dry (Usher, 1984). The peduncle and petiole are cut into small pieces, dried and fried in oil is a delicious food item and is sold in the name, '*vattal*' in Kerala (Pers. Obs. Swapna). Paste of young leaf, along with fruits of *Emblica myrobalan* is applied on forehead to get relief from headache. Flower petal decoction is given against diarrhea. Young flower paste is prescribed as cardiac tonic and also in fever and liver ailments. Young seed powder is taken along with fresh cow milk against headache. Young seed paste is used externally as a cooling medicine for skin diseases. Powdered root is taken for expelling ring worms. Root paste kept in a fine cloth and rolled to a thread and dipped in cow ghee is inserted inside the nostril of the unconscious patient suffering from fits and kept till the patient becomes conscious. Root paste in lemon juice is taken for the treatment of piles (Panda and Misra, 2011).

***Nymphaea nouchali* N.L.Burman**

Nymphaeaceae; Vellambel, Indian Waterlily; Indo-

Malaysia and Tropical Africa, widely distributed in India; common and locally dominant in permanent and temporary water; A large, aquatic herb with tuberous rhizome and peltate leaves, flowers solitary, fragrant, variable in colour, deep red to pure white, fruit a spongy berry.

All parts of the plant are eaten in times of scarcity. The rhizome is considered demulcent and used for dysentery and dyspepsia. Flowers are astringent and cardiotoxic. Seeds are used as a cooling medicine in cutaneous diseases (Wealth of India, Vol. VII). Rhizome along with roots of *Lawsonia inermis* grinded in rice washed water is taken to cure diabetes. Flowers are soaked in water overnight; decanted water is drunk for various cardiac problems. Seed decoction soaked in cloth is applied for the treatment of skin infection. Raw rhizome is the best medicine for dysentery (Panda and Misra, 2011).

***Nymphaea pubescens* Willd.**

Nymphaeaceae; Periyambel; Indo – Malaysia, distributed throughout in India; Leaf blades green above, brownish or purplish below, lower surface pubescent, flowers white to pink or deep red. Seeds almost black with a white aril. Decoction of rhizome of red flowered plant is given for blood dysentery. Rhizome juice is prescribed against leucorrhoea. Powdered rhizome with honey is given for piles, dysentery and dyspepsia. Root juice is drunk to keep stomach cool and to get relief from burning sensation during urination. Root paste of the red flowered plant is given for treating menorrhagia. Paste of root of the plant with flowers of *Hibiscus rosa-sinensis*, bark of *Ficus religiosa* and seeds of *Sesamum indicum* is taken for abortion (Panda and Misra, 2011).

***Nymphoides hydrophylla* O. Kuntze**

Menyanthaceae; Cheruthettambal, Neythel, Floating heart; Indo-Malaysia and South China, in India it is distributed in Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Assam, Bihar, Delhi, Goa, Himachal Pradesh, Madhya Pradesh, Maharashtra, Manipur, Orissa, Punjab, Rajasthan, Uttar Pradesh and West Bengal; An aquatic herb deeply rooted in mud in lakes, tanks and temporary pools and in slowly flowing water; plant with long floating stem rooting at the nodes, leaves purplish beneath, flowers white, yellow within.

Stems, leaves and fruits are eaten. Used as substitute for *Swertia chirata* Buch. Used in fevers and jaundice. Stalks and leaves are pounded with oil and applied to ulcers and insect bites. A decoction is used as a wash for parasitic skin affections. Seeds are considered as an anthelmintic (Wealth of India, Vol. VI). Leaf juice drops are applied against eye disease. Leaf paste is used as an antidote for scorpion sting and snake bite. Seed powder

with honey is taken orally as an anthelmintic (Panda and Misra, 2011).

***Nymphoides indica* (L.) Kuntze**

Menyanthaceae; Chinnambel; Paleotropic, distributed throughout in India; annual or perennial, common and abundant in fresh and brackish water in lakes, pools and tanks rarely in flowing water; blades of floating leaves glossy green above, pale and gland dotted below, flowers bisexual, pure white or white with a yellow or orange base, seeds yellowish white.

Leaf paste is applied on forehead to get relief from headache due to bile. Plant decoction is drunk to cure fever and dysentery. Dried plants are dipped in sesamum oil for 7 days; the oil is filtered, stored and applied externally to get relief from headache, rheumatism and bile. Leaf paste with turmeric is applied externally to cure scabies; applied on the swelling part of the body to get relief (Panda and Misra, 2011).

***Oryza sativa* Linn.**

Poaceae; Nello, Paddy; Widely cultivated species; An annual or perennial grass without a rhizome; leaf blades linear, spikelets persisting, caryopses oblong, cylindrical, whitish yellow, brown to reddish brown. It is one of the oldest of food crops and the basic diet of over half the world's population. The grain is used to make a wide variety of dishes and as stock food. It is fermented to make rice wines. An oil is extracted from the husk and it has a high vitamin B1 content and is used in the treatment and prevention of beri – beri. The extensive and exclusive use of polished rice leads to the development of beri- beri and this could be reduced by parboiling the rice before milling and then undermilling (Usher, 1984).

***Ottelia alismoides* Persoon**

Hydrocharitaceae; Duck lettuce; Indo-Malaysia to Pacific Islands and East Asia, in India it is widely distributed; found in permanent, still or slowly flowing water or in temporary pools and in rice fields; A succulent, flaccid, aquatic herb, leaves totally submerged, flowers white, polygamous, but in India, mostly bisexual, fruit ovoid to cylindrical, seeds densely covered with whitish, unicellular hairs.

The leaves, petioles and inflorescences possess an excellent flavor and are eaten in South East Asia. The plant possesses rubifacient properties. In Philippines, the leaves are used in topicals to cure haemorrhoids; they are also applied as poultices on arms and legs in fever (Wealth of India, vol.VII).

***Phyla nodiflora* (L.) E. Greene**

Verbenaceae; Neerthippali; tropics and subtropics, it is distributed throughout India,; found in regularly flooded areas, common on the irrigation ditches and ponds; stems creeping and rooting at nodes, pubescent, inflorescence a very dense, many flowered cylindrical spike, flowers white to rose – purple.

The whole plant is used to cure skin diseases (Santhoshkumar and Satyanrain, 2010). Alkaloids reported from the plant showed significant analgesic, anti-inflammatory, and anti pyretic activities (Costa et al., 1989; Forestieri et al., 1996). Halleridone and Hallerone compounds isolated from *P. nodiflora* (Ravikanth et al., 2000) are used for anti-cancer, anti-tumor, anti-malarial, anti-fungal and cytotoxic activities (Nishino et al., 1988).

***Pistia stratiotes* Linn.**

Araceae; Muttapayal, Water lettuce; distributed in Tropics and Subtropics, in India it is distributed in Karnataka, Kerala, Assam, Bihar, Goa, Gujrat, Madhya Pradesh, Manipur, Rajasthan and West Bengal; Free floating rosettes with emergent leaves in tanks, lagoons and rice fields. Forms a dense mat on water surface and cause serious clogging of water ways; a floating, stoloniferous herb, leaves sessile, densely pubescent, flowers creamy white, minute and sessile on a spadix.

The plant is eaten in parts of Tropical Africa and in India, in times of famine. Young leaves are cooked and eaten by the Chinese. Used as an antiseptic, antidyscentric, insecticide and for ear complaints. In Gambia, the plant is used as an anodyne for eyewash. The ashes of the plant are applied to the ring worm of the scalp. The leaves are used in eczema, leprosy, ulcers, piles and syphilis. With rose water and sugar, they are given for cough and asthma. Juice of the leaves boiled in coconut oil and applied externally to cure chronic skin diseases

Whole plant is boiled and tied at the rheumatic swollen parts of the body to reduce the swelling. Leaf juice boiled with coconut oil is applied externally to cure skin diseases, leprosy and eczema. Plant decoction is taken to cure irregular urination (Panda and Misra, 2011).

***Polygonum barbatum* Steward**

Polygonaceae; Velutha muthalamookku; Paleotropics, Widely distributed in India; gregarious near rivers and streams, in marshes, in shallow water in pools and ditches and in floating mats of vegetation; stem erect or creeping below, ochreas membranous, flowers in terminal and axillary, long spike like racemes and perianth white. The ground leaves are used to prevent bleeding from wounds (Usher, 1984). A decoction of the

shoot is used as a stimulating wash for ulcer. The seeds possess tonic, purgative and emetic properties and are used in colic pain. Roots are considered astringent and cooling agent. Seeds are used in relieving colic pain (Wealth of India, Vol. VIII).

The internodal part is used as beads for the preparation of a chain which is tied around the neck of young children suffering from conjunctivitis (Panda and Misra, 2011). Seeds used for relieving the gripping pain of colic. Root used as an astringent, leaves and stalks used for washing ulcer (Maya et al., 2003).

***Polygonum glabrum* Willdenow**

Polygonaceae; Chuvanna muthalamookku; Paleotropics, In India: Karnataka, Kerala, Tamil Nadu, Arunachal Pradesh, Assam, Bihar, Goa, Gujrat, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Sikkim, Uttar Pradesh and West Bengal; gregarious along water courses and tanks and in marshes; stem erect, shrubby, ochreas membranous, glabrous, lowers in terminal and axillary spike like racemes, perianth rose or red. Nuts dark brown and shiny.

The young shoots and roots are cooked with vegetables. The juice of the plant along with other ingredients is given for pneumonia. An infusion of the leaves is given for colic and also prescribed as a febrifuge. The rootstocks are reported to be used for piles, jaundice, debility and consumption. Paste of leaves with black pepper is taken with honey to cure fever and colic pain (Panda and Misra, 2011). Also, used to unlock bone (Santhoshkumar and Satyanarain, 2010).

***Polygonum hydropiper* Linn.**

Polygonaceae; Water pepper; Pantropical, In India: Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Assam, Madhya Pradesh, Maharashtra, Manipur, Orissa, Rajasthan, Sikkim, Uttar Pradesh, West Bengal; on moist rich soils which are regularly flooded and along the margins of ponds and in irrigation ditches; stem erect, prostrate or creeping and rooting, ochreas glabrous or hairy, flowers in terminal or axillary, lax spike like racemes, perianth rose to white with yellowish transparent glands.

The herb has an acrid-peppery taste and is used as a flavoring. Possesses stimulant, diuretic, styptic, emmenagogue and lithonitriptic properties. Liquid extract of the plant is reported to be used as an oral contraceptive. The leaves are chewed to relieve tooth ache. The roots are bitter and are said to possess stimulant, diuretic, carminative, tonic and anthelmintic properties. The juice is used as a sash for skin affections. An infusion of the herb is used in uterine disorders and as a haemostatic (Wealth of India, Vol. VIII).

***Polygonum plebeium* R. Brown**

Polygonaceae; small knotweed; Pantropical, widely distributed in India; forms dense prostrate mass in rivers, canals and drying out pools; diffusely branched, very variable, sub erect or prostrate under shrubs with a woody rootstock, ochreas lacerate, flowers in axillary clusters, perianth rose. It is used as a vegetable. Powdered herb is given for pneumonia and the rootstock is used against bowel complaints (Wealth of India, Vol. VIII).

***Rotula rotundifolia* (Roxb.) Koehne**

Lythraceae; round leaf toothcup; It is found in South and South East Asia, Japan and almost throughout in India; found growing submerged, emergent or terrestrial in wet places; stem branched, woody below, leaves green or red on the abaxial surface, inflorescence a many flowered pedunculate raceme, flowers bright rose. Juice of the aerial part of plant is given to cure cough, cold and fever (Panda and Misra, 2011).

***Rotula indica* (Willd.) Koehne**

Lythraceae; Tropica Asia, naturalized in Europe, Africa and America, found throughout in India; common in a wide variety of wetland habitats; stems erect or decumbent, weakly 4- angled or terete, leaf margin cartilaginous, flowers solitary, sessile or subsessile. Leaves and flowers are used for respiratory diseases and stomach disorder (Santhoshkumar and Satyanarain, 2010).

***Rotula aquatica* Lour.**

Boraginaceae; Kallurvanchi; Pantropical, In India: Karnataka, Kerala, Tamil Nadu, Goa, Gujrat, Andhra Pradesh, Assam, Madhya Pradesh, Rajasthan, Uttar Pradesh; found in rocky river banks and among pebbles in the beds of rivers and streams, submerged during the wet season; much branched, small shrub, leaves simple, flowers small, in the axils of leaves, pink to purple.

Roots are valued in Ayurveda and a decoction of roots is used as diuretic and laxative and for piles (Wealth of India, Vol. IX). Fresh or dried root after removing the outer skin is sliced or crushed and is boiled with water is taken twice daily for 14 days as a treatment for kidney stone (Pers. Obs.).

***Sphaeranthus indicus* Linn.**

Asteraceae; Adakkamaniyan, Indian Globe Flower; Indo-

Malaysia, Australia and Africa, distributed almost throughout in India; Common in and around irrigation ditches and rice fields; an aromatic herb, stems with toothed wings, flowers in heads and purple in color.

The leaves are eaten as a pot herb. The juice of the plant is styptic and said to be useful in liver and gastric disorders. The paste of the herb, made with oil is applied in itch. The powdered seeds and roots are given as an anthelmintic. A decoction of the root is used in chest-pains and bowel complaints.

The bark, ground and mixed with whey, is said to be a useful application in piles. Flowers are credited with alterative, depurative and tonic properties. Leaf juice boiled with milk and sugar-candy is prescribed for cough (Wealth of India, Vol. X). The leaves are used to treat intestinal worms, the plant cooked in butter, flour and sugar is a tonic and fried or boiled seeds are used as an aphrodisiac. In Java, the plants are used as a diuretic (Usher, 1984). Paste prepared from inflorescence is given in empty stomach for curing excess bile. Whole plant paste with a pinch of common salt is taken as an anthelmintic. Stem with leaf is chewed to get relief from toothache.

***Sphenoclea zeylanica* Gaertner**

Campanulaceae; Pantropical, In India: Kerala, Goa, Karnataka, Andhra Pradesh, Assam, Delhi, Punjab, Rajasthan, Uttar Pradesh and West Bengal; found in swampy areas, along the banks of water courses and in rice fields; an erect annual herb, inflorescence a dense, terminal spike with small, greenish yellow flowers. The young plants and tips of older plants are steamed and eaten as vegetable with rice in Java (Usher, 1984).

***Spilanthes calva* A. P. de Candolle**

Asteraceae; Eriopacha, Paracress; Indo-Malaysia and China, In India: Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Assam, Madhya Pradesh, Meghalaya and Rajasthan; found in boggy ground, margins of pools, marshes along water courses, in rice fields and in wet areas; stem trailing or ascending, flowering heads long pedunculate, solitary, flowers yellow. The leaves are eaten raw or as a vegetable (Usher, 1984). The flower-heads are chewed to relieve toothache and affections of throat and gums and paralysis of the tongue. They are also said to be a popular remedy for stammering in children in Western India.

The plant is boiled in water and the liquid as well as solid is given in dysentery. The decoction is employed as a bath for rheumatism and as a lotion in scabies and psoriasis. The root is used as a purgative (Wealth of India, Vol. X). It is used locally to cure tooth ache (Pers. Obs. Swapna).

***Trapa natans* Linn.**

Trapaceae; Panver chirava, Water Chestnut; Pantropical, In India: Karnataka, Kerala, Goa, Assam, Bihar, Delhi, Haryana, Maharashtra, Manipur, Rajasthan, Uttar Pradesh and West Bengal; found in still or slowly flowing water, cultivated in tanks, lakes, ponds, etc.; a very variable, rooted aquatic herb, stem elongate and submerged, leaves dimorphic, flowers solitary, white or lilac.

The fruits are eaten raw or cooked. In China, they are also used for making flour. It is cultivated in Asia (Singhara in India) and elsewhere where it is a staple food (Cook, 1996).

***Typha domingensis* Persoon**

Typhaceae; Lesser cats tail, Elephant grass; Cosmopolitan in distribution; dominant in fresh and brackish marshes, back waters, lagoons pools and along water courses; a gigantic, gregarious marshy plant, female inflorescences light cinnamon brown.

The immature inflorescence is used as food (Cook, 1996). The starchy rhizomes and pollen are also eaten. The rhizomes are astringent and diuretic and are reported to be employed in dysentery, gonorrhoea and measles. Rhizome decoction is used as an astringent (Panda and Misra, 2011).

***Vallisneria spiralis* Linn.**

Hydrocharitaceae; Tape grass; Pantropical, widely distributed in India; grows in still and flowing water; a submerged, tufted, dioecious aquatic herb, stem very short, leaves totally submerged, linear, varying in length with the depth of water.

The young leaves are eaten in salads in Japan (Cook, 1996; Usher, 1984). They are rich source of phosphorous, calcium and iron and the plant is used as a stomachic and for leucorrhoea (Wealth of India, Vol. X).

***Vetiveria zizanioides* (Linn.) Nash**

Poaceae; Ramacham, Vetiver; distributed in India, Myanmar and Sri Lanka, in India: Karnataka, Kerala, Tamil Nadu, Goa, Andhra Pradesh, Delhi, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal; found in seasonally inundated places around tanks and ponds and in ditches; a densely tufted, rhizomatous grass, inflorescence a panicle, spikelets in pairs, 2-flowered, caryopses enclosed in spiny glumes.

Water boiled with the aromatic roots is good to quench thirst Pers. Obs. Swapna). The rhizome is used in the treatment of rheumatism, the vetiver oil is reported to be

used as a carminative in flatulence, colic and obstinate vomiting (Wealth of India, Vol. X). The underground parts are used as refrigerant, diaphoretic and febrifuge (Santhoshkumar and Satyanarain, 2010).

***Wedelia chinensis* (Osbeck) Merr.**

Asteraceae; native of Tropical America, introduced in India; found in marshy places, prostrate or diffuse perennial herbs, leaves opposite, heads axillary, solitary, heterogamous and yellow in color.

Plant juice is used in the preparation of Brahmi oil for proper growth of hair and is directly used for blackening of hair (Panda and Misra, 2011).

***Xyris indica* Linn.**

Xyridaceae; Kochilletri; Indo-Malaysia, in India it is distributed in Karnataka, Kerala, Goa and Assam; found in wet sand or muddy soil in swampy places, or in shallow water in streams, pools, ditches and canals and in rice fields; a robust, scapigerous herb with grass like leaves and bright yellow flowers. The whole plant paste is applied externally to cure ringworm, itches and leprosy (Panda and Misra, 2011).

DISCUSSION

Each and every plant in the world is useful in some way or other. Earlier, the plants are utilized based on the "Doctrine of Signature" that is, God wood mark or sign each plant in some way or the other to indicate its medicinal property. Cook (1996) in his aquatic and wetland plants of India gave some short notes on the utility of the plants. The present review describes the edible and medicinal properties of 72 wetland plant species and point out that species like *P. stratiotes*, *V. spiralis*, etc. which is becoming serious weeds in the water bodies of the country, can be effectively utilized for their food and medicine attributes, which will change the status of the plants from worst weed to important medicines or food which are useful for mankind. In the present study, some new observations are discussed such as the plant *L. crustacea* is crushed and the expressed juice is taken in early morning in empty stomach to clear stomach, the roots of *L. oppositifolia* are used locally for fever, the peduncle and petiole of *Nelumbo nucifera* are cut into small pieces, dried and fried in oil is a delicious food item and is sold in the name, 'vattal' in Kerala. Fresh or dried root of *R. aquatica* after removing the outer skin is sliced or crushed and is boiled with water is taken twice daily for 14 days as a treatment for kidney stone, *C. axillaris* is used for relief from inflammation in the eardrum and *S. calva* is used locally

to cure tooth ache. The nutritive values of some of the plants have been studied by various authors and the present enumeration emphasize the usefulness of the wetland plant wealth which in turn may form another criteria to conserve the delicate ecosystems considering the services they provide to the mankind.

ACKNOWLEDGEMENTS

Authors are thankful to the Kerala State Council for Science, Technology and Environment, for the financial assistance and the authorities of Malabar Botanical Garden, Kozhikode for providing research facilities. We are thankful to the officials of Kerala Forest Department for providing permission during field studies.

REFERENCES

- Abdulla MA, Al-Bayaty FH, Younis LT, Abu Hassan MI (2010). Anti-ulcer activity of *Centella asiatica* leaf extract against ethanol-induced gastric mucosal injury in rats. *J. Med. Plants Res.*, 4(13): 1253-1259, <http://www.academicjournals.org/JMPR>
- Abdul S, Mahmood A, Asharaf CM, Siddiqui MR (1994) Pharmacognostic study and chemical/pharmacological evaluation of Brahmi-buti. *Hamdard Med.*, 37(3): 92-109.
- Anonymous (1976). Wealth of India, C.S.I.R., Vol. 1-10, New Delhi.
- Balakumbahan R, Rajamani K, Kumanan K (2010). *Acorus calamus*: An overview. *J. Med. Plants Res.*, 4(25): 2740-2745, <http://www.academicjournals.org>.
- Baxter RM (1960). Separation of the hypnotic-potentiating principles from the essential oil of *Acorus calamus* L. of Indian origin by liquid gas chromatograph. *Nature*, 185: 466-467.
- Bhuvanewari R, Balasundaram C (2009). Anti-bacterial activity of *Acorus calamus* and some of its derivatives against fish pathogen *Aeromonas hydrophila*. *J. Med. Plants Res.*, 3(7): 538-547.
- Bohlmann F, Chen ZL (1984). New guaianolides from *Centipeda minima*. *Chin. Sci. Bull.*, 29: 900-903.
- Cheng JH, Li YB (1998). Anti-tumor Herbal Medicines and Their Proved Recipes; Jiangxi Science and Technology Press, Jiangxi, China, p. 732.
- Chopra RN, Nayar SL, Chopra IC (1956). Glossary of Indian Medicinal Plants. CSIR, New Delhi, p. 58.
- Chopra IC, Khajuria BN, Chopra CL (1957). Antibacterial properties of volatile principles from *Alpinia galanga* and *Acorus calamus*. *Antibiot. Chemother.*, 1: 378-383.
- Chung YM, Lan YH, Hwang TL, Leu YL (2011). Anti-Inflammatory and Antioxidant Components from *Hygroryza aristata*. *Molecules*, 16: 1917-1927; doi:10.3390/molecules16031917.
- Cook CDK (1996). Aquatic and wetland plants of India. Oxford University press Inc., New York.
- Costa M, Di S, Kirizawa LC, Mendacoli M, Gomes SL, Trolin CG (1989). Screening in mice of some medicinal plants used for analgesic purposes in the state of Sao Paulo. Part II. *J. EthnoPharmacol.*, 27: 25-33.
- Cox DN, Rajasuriya S, Soysa PE, Glaswin J, Ashworth A (1993). Problems encountered in the community based production of leaf concentrate as a supplement for pre-school children in Sri Lanka. *Int. J. Food Nutr.*, 44: 123-132.
- Forestieri AM, Monforte MT, Ragusa S, Trovato A, Lauk L (1996). Anti-inflammatory, analgesic and pyretic activity in rodents of plant extracts used in Africa medicine. *Phytother. Res.*, 10: 100-106.
- Grosvenor PW, Suptino A, Gray DO (1995). Medicinal plants from Rian province, Sumatra, Indonesia, Part 2; antibacterial and antifungal activity. *J. Ethnopharmacol.*, 45: 97-111.
- Hewawasam KAPW, Jayatilaka KAPW, Pathirana C, Mudduwa LKB

- (2004). Hepatoprotective effect of *Epaltes divaricata* extract on carbon tetrachloride induced hepatotoxicity in mice. *Ind. J. Med. Res.*, 120: 30-34.
- Hong SS, Kim JH, Shim CK (2005). Advanced formulation and pharmacological activity of hydrogel of titrated extract of *C. asiatica*. *Arch. Pharm. Res.*, 28: 502-508.
- Inngjerdigen KT, Sylvi C, Debes IM, Hokputsa S, Stephen EH, Bent R, Terje E, Michaelsen DD, Paulsen BS (2005). Bioactive pectic polysaccharides from *Glinus oppositifolius* (L.) Aug. DC., a Malian medicinal plant, isolation and partial characterization. *J. Ethnopharm.*, 101: 204-214.
- Jayaweera DMA (1981). Medicinal plants used in Ceylon, vol. II Colombo: Natl. Sci. Council. Sri Lanka, pp. 68-69.
- Kamble SY, Patil SR, Sawant PS, Sawant S, Pawar SG, Singh EA (2010). Studies on Plants used in traditional medicine by *Bhillia* tribes of Maharashtra. *Ind. J. Trad. Know.*, 9(3): 591- 598.
- Kan WS (1986). Pharmaceutical botany, National Research Institute of Chinese Medicine, Taipei, Taiwan, pp. 416-417.
- Kartnig T, Cracker LE, Simon JE (1988). Herbs spices and Medicinal Plants 3, Oryx Press, AZ, p. 145.
- Lewis WH, Lewis MPFE (2003). Medical Botany: Plants affecting human health. Wiley Publishers, New Jersey, p. 112.
- Lin R, Shi Z (2005). *Pharmacopoeia of China*, Science Publishing House, Beijing, China, p.132.
- Madhusoodanan PV, Kumar KGA (1993). *Alternanthera philoxeroides* Griseb. – Alligator weed - A fast spreading aquatic weed in Kerala, South India. *J. Econ. Taxon. Bot.*, 17: 651-654.
- Ma G, Chong L, Li Z, Cheung AH, Tattersall MH (2009). Anticancer activities of sesquiterpene lactones from *Cyathocline purpurea* in vitro. *Cancer Chemother. Pharmacol.*, 64(1): 143-152.
- Maquart FX, Bellon G, Gillery P, Wegrowski Y, Borel JP (1990). Stimulation of collagen synthesis in fibroblast cultures by triterpene extracted from *C. asiatica*. *Connect. Tissue Res.*, 24: 107-120.
- Maya S, Menon SV, Nair SG (2003). Economic importance of river vegetation of Kerala – A case study. *J. Econ. Taxon. Bot.*, 27(4): 796-803.
- Naples ML (2005). Weeds of rain fed lowland rice fields of Laos & Cambodia. Unpublished M.Sc Thesis, Univ. Leiden, The Netherlands.
- Nishino C, Kobayashi K, Fukushima M (1988). Halleridone, a cytotoxic constituent from *Cornus controversa*. *J. Nat. Prod.*, 51: 1281-1282.
- Panda A, Misra MK (2011). Ethnomedicinal survey of some wetland plants of South Orissa and their conservation. *Ind. J. Trad. Knowl.*, 10(2): 296–303.
- Rani AS, Satyakala M, Devi VS, Murty US (2003). Evaluation of antibacterial activity from rhizome extract of *Acorus calamus*. *J. Sci. Ind. Res.*, 5: 621-623.
- Ravikanth V, Ramesh P, Diwan PV, Venkateswarlu Y (2000). Halleridone and Hallerone from *Phylla nodiflora* (L.) Greene. *Biochem. Syst. Ecol.*, 28: 905-906.
- Santhoshkumar B, Satyanarain S (2010) Herbal remedies of wetlands macrophytes in India. *Int. J. Pharm. Biosci.*, 2: 1-12.
- Shanmugasundaram P, Venkataraman S (2005). Anti-nociceptive activity of *Hygrophila auriculata* (Schum.) Heine. *Afr. J. Trad. C.A.M.*, 2(1): 62- 69.
- Scher J (2004). Federal Noxious Weed disseminules of the U.S. Center for Plant Health Science and Technology, Plant Protection and Quarantine, Animal and Plant Health Inspection Service, U.S. Dept. Agric. <http://www.lucidcentral.org>.
- Shetty BS, Udupa SL, Udupa AL, Somayaji SN (2006). Effect of *C. asiatica* Linn. on normal and dexamethasone-suppressed wound healing in Wistar Albino rats. *Int. J. Low Extrem. Wounds*, 5: 137-143.
- Singh RH, Singh RL (1980). Studies on the anti anxiety effect of the Medhya rasayana drug, Brahmi (*Bacopa monnieri* Wettst) Part I. *J. Res. Ayur Sidha*, 1: 133-148.
- Sahakitpichan P, Disadee W, Ruchirawat S, Kanchanapoom T (2010). L-(–)-(N-trans-Cinnamoyl)-arginine, an Acylamino Acid from *Glinus oppositifolius* (L.) Aug. DC. *Molecules*, 15: 6186-6192; doi: 10.3390/molecules15096186.
- Singh A, Kandasamy T, Odhav B (2009). *In vitro* propagation of *Alternanthera sessilis* (sessile joy weed), a famine food plant. *Afr. J. Biotechnol.*, 8(21): 5691-5695. <http://www.academicjournals.org/AJB>
- Su M, Li Y, Chung HY, Ye W (2009). 2β-(Isobutyryloxy)florilenalin, a Sesquiterpene Lactone Isolated from the Medicinal Plant *Centipeda minima*, Induces Apoptosis in Human Nasopharyngeal Carcinoma CNE Cells. *Molecules*, 14: 2135-2146; doi:10.3390/molecules14062135.
- Thomas M (2008). Edible Water Plants: Aquatic Vegetables. Nature's Water, <http://www.natures-water.com>.
- Tripathi YB, Chaurasia S, Tripathi E, Upadhyay A, Dubey GP (1996). *Bacopa monnieri* Linn. as an antioxidant mechanism of action. *Indian J. Exp. Biol.*, 4(6): 523-526.
- Usher G (1984). A Dictionary of Plants. CBS Publishers and Distributors, New Delhi.
- Wu JB, Chun TT, Ebizuka Y, Sankawa U (1985). Biologically active constituents of *Centipeda minima*: Isolation of a new plenolin ester and the anti-allergy activity of sesquiterpene lactones. *Chem. Pharm. Bull.*, 33: 4091-4094.
- Wu JB, Chun TT, Ebizuka Y, Sankawa U (1991). Biologically active constituents of *Centipeda minima*: Sesquiterpenes of potential anti-allergy activity. *Chem. Pharm. Bull.*, 14: 3272-3275.
- Zhang YH (2000). A Collection of Anticancer Chinese Medicines. Jiangsu Science and Technology Publishing House: Nanjing, China, p. 435.